

# Development of a Hard X-ray Photoelectric Polarimeter

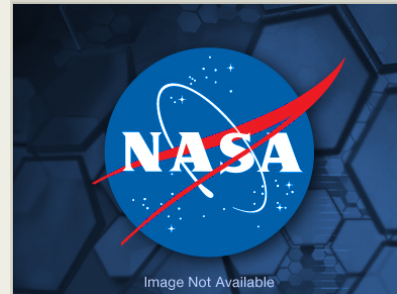
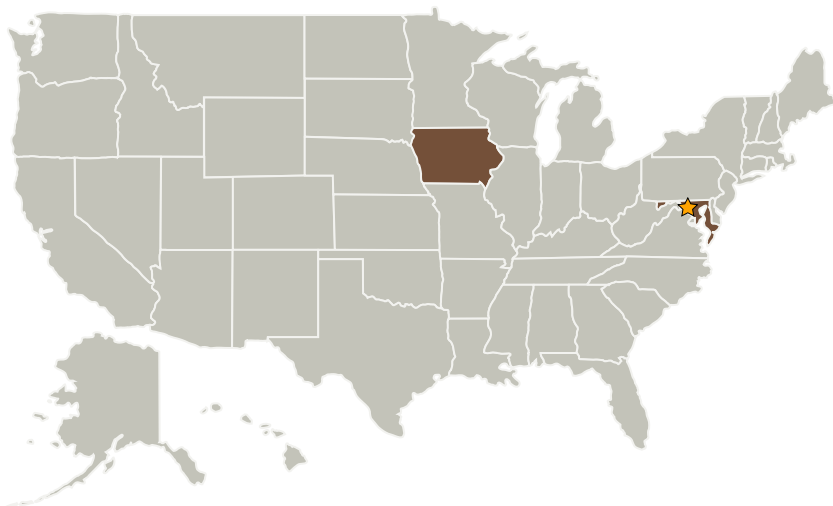
Completed Technology Project (2017 - 2019)



## Project Introduction

We propose the optimization of the Time Projection Chamber (TPC) polarimeter developed for the Gravity and Extreme Magnetism Small Explorer (GEMS) and Polarimeters for Relativistic Astrophysical X-ray Sources (PRAXyS) Small Explorer to measure the polarization of cyclotron lines in Neutron Stars in the 10-70 keV energy band. Linear polarization measurements would provide unique and important constraints on theories. Recently, photoelectric polarimetry with gas micropattern detectors has been demonstrated as a sensitive, practical technique for polarimetry at the focus of an X-ray mirror. While development has concentrated on polarimeters for the 2-10 keV band, this technique would be effective for hard X-ray measurements in the energy range of detected cyclotron absorption lines. Our objective is to determine the gas mixtures and pressures that would enable a sensitive, hard X-ray polarimeter using existing flight components (~\$10M) with the goal of making astrophysical measurements using the InFOC $\mu$ S hard X-ray optics on a long duration balloon flight (future proposal following successful demonstration). We propose to find the optimization that allows the maximum reuse of existing flight hardware and engineering prototype hardware. The photoelectric polarimetry technique combines high sensitivity with broad band-pass and is potentially the most powerful method between 10 and 70 keV, where the photoelectric effect is the dominant interaction process in many materials. It is expected that this project would lead to a follow-on proposal for either a long duration balloon flight with the GEMS-polarimeter at the focus of the existing InFOC $\mu$ S mirrors or other mission of opportunity.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Science Mission Directorate (SMD)

### Lead Center / Facility:

Goddard Space Flight Center (GSFC)

### Responsible Program:

Astrophysics Research and Analysis

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| Organizations Performing Work      | Role                    | Type        | Location            |
|------------------------------------|-------------------------|-------------|---------------------|
| ★Goddard Space Flight Center(GSFC) | Lead Organization       | NASA Center | Greenbelt, Maryland |
| Rock Creek Scientific              | Supporting Organization | Industry    |                     |
| University of Iowa                 | Supporting Organization | Academia    | Iowa City, Iowa     |

## Primary U.S. Work Locations

|      |          |
|------|----------|
| Iowa | Maryland |
|------|----------|

## Project Management

**Program Director:**

Michael A Garcia

**Program Manager:**

Dominic J Benford

**Principal Investigator:**

Joe Hill-kittle

**Co-Investigators:**

David T Leisawitz

Kevin Black

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Alice K Harding

Philip Kaaret

Takao Kitaguchi

## Technology Areas

**Primary:**

- TX08 Sensors and Instruments
  - └ TX08.2 Observatories
    - └ TX08.2.1 Mirror Systems

## Target Destination

Outside the Solar System